

AMENDMENT TO THE CLAIMS:

Please amend claims 1, 2, 11, 19, 26, 27 and 35 as follows:

1. (Twice amended) A planar laser illumination and imaging (PLIIM) based system comprising:
 - a system housing having first, second and third light transmission apertures linearly aligned with and optically isolated from each other, and said third light transmission aperture being disposed between said first and second light transmission apertures;
 - a linear image formation and detection module disposed in system housing, and having image formation optics with a field of view projectable through said third light transmission aperture and onto an object moving relative to said first, second and third light transmission apertures during object illumination and imaging operations; and
 - a pair of planar laser illumination arrays (PLIAs) disposed [on] in said system housing, each said planar laser array (PLIA) including a plurality of laser diodes arranged together in a linear manner and said planar laser illumination arrays being arranged in relation to said linear image formation and detection module, and for producing a pair of planar laser illumination beams (PLIBs), and projecting said pair of stationary planar laser illumination beams through said first and second light transmission apertures and oriented such that the plane of said planar laser illumination beams is coplanar with the field of view of said linear image formation and detection module so that the object can be simultaneously illuminated by said planar laser illumination beams and imaged within said field of view of said linear image formation and detection module,

whereby a series of linear images of said object are sequentially detected by said linear image formation and detection module as said object moves past first, second and third light transmission apertures, so that said series of linear images can be grabbed and buffered for subsequent use in constructing two-dimensional images of said object.
2. (Twice Amended) The [PLIIM based] PLIIM-based system of claim 1, which further comprises:
 - an image frame grabber for grabbing linear images formed and detected by said image linear formation and detection module,
 - an image data buffer for buffering said linear grabbed images;
 - an image processing computer operably associated with said image data buffer, for processing said buffered linear images; and

a camera control computer for controlling said linear image formation and said detection module, and said pair of planar laser illumination arrays.

11. (Twice Amended) The PLIIM-based system of Claim 10, which further comprises:

an image frame grabber, disposed within said system housing, for grabbing linear images formed and detected by said linear image formation and detection module,

an image data buffer, disposed within said system housing, for buffering said grabbed [image] linear images;

an image processing computer, operably connected to said image data buffer, for processing said buffered [image] linear images; and

a camera control computer, disposed within said system housing, for controlling said linear image formation and said detection module.

19. (Twice Amended) The PLIIM-based system of Claim 18, which further comprises:

an image frame grabber, disposed within said system, for grabbing linear images framed and detected by said image formation and detection module,

an image data buffer, disposed within said system housing, for buffering said grabbed [image] linear image;

an image processing computer, operably associated therewith, for processing said buffered [image] linear images; and

a camera control computer for controlling said linear image formation and said detection module.

26. (Twice Amended) A planar laser illumination and imaging (PLIIM) based system comprising:

a system housing having first, second and third light transmission apertures linearly aligned with and optically isolated from each other, and said third light transmission aperture being disposed between said first and second light transmission apertures;

a linear image formation and detection module disposed in said system housing and having a linear detection array and image forming optics with a field of view projectable through said third light transmission aperture and onto an object moving relative to said first, second and third light transmission apertures during object illumination and imaging operations;

a field of view (FOV) folding/sweeping mirror, disposed in said system housing, for folding and sweeping the field of view of said linear image formation and detection module over

a range of predetermined directions definable with respect to said third light transmission aperture;

a pair of planar laser illumination arrays (PLIAs), disposed in said system housing, each said planar laser illumination array including a linear array of laser diodes arranged together as a laser diode module, and said planar laser illumination arrays being arranged in relation to said image formation and detection module, and producing first and second planar laser illumination beams (PLIBs); and

a pair of planar laser beam folding/sweeping mirrors, disposed on said system housing, and jointly or synchronously movable with said FOV folding/sweeping mirror, and arranged so as to fold and sweep the optical paths of the first and second planar laser illumination beams through said first and second light transmission apertures, respectively, so that the folded field of view of said linear image formation and detection module is jointly or synchronously moved with said first and second planar laser illumination beams in a direction that is substantially coplanar therewith as said first and second planar laser illumination beams are swept over a 3-region of space so that the object can be simultaneously illuminated by said planar laser illumination beams and imaged within said field of view of said linear image formation and detection module,

whereby a series of linear images of said object are sequentially detected by said linear image formation and detection module as said object moves past said first, second, and third light transmission apertures, so that said series of linear images can be grabbed and buffered for subsequent use in constructing two-dimensional images of said object.

27. (Twice Amended) The PLIIM-based system of claim 26, which further comprises:

an image frame grabber, disposed within said system housing, for grabbing linear images formed and detected by said image formation and detection module,

an image data buffer, disposed within said system housing, for buffering said grabbed [image] linear images;

an image processing computer, operably associated with said image data buffer, for processing said buffered [image] linear images; and

a camera control computer, disposed within said system housing, for controlling said linear image formation and said detection module.

35. (Twice Amended) A planar laser illumination and imaging (PLIIM) based system comprising:

a system housing having first, second and third light transmission apertures linearly aligned with and optically isolated from each other, and said third light transmission aperture being disposed between said first and second light transmission apertures;

a linear image formation and detection module disposed in said system housing, and having a linear detection array and image forming optics with a field of view projectable through said third light transmission aperture and onto an object moving relative to said first, second and third light transmission apertures, during object illumination and imaging operations; and

a pair of planar laser illumination arrays (PLIAs) disposed in said system housing, each said planar laser illumination array including a plurality of laser diodes arranged together, and said pair of planar laser illumination arrays being arranged in relation to said linear image formation and detection module, and for producing a first and second planar laser illumination beams (PLIBs) and projecting said first and second planar laser illumination beams through said first and second light transmission apertures and oriented, such that the plane of said planar laser illumination beams is coplanar with the field of view of said linear image formation and detection module so that the object can be simultaneously illuminated by said planar laser illumination beams and imaged within said field of view of said linear image formation and detection module;

an image frame grabber, disposed in said system housing, for accessing linear images from said linear image formation and detection module;

an image data buffer, disposed in said system housing, for buffering said grabbed linear images received from said image frame grabber; and

a camera control computer, disposed in said system housing, for controlling the operation of said PLIIM-based system;

whereby a series of linear images of the object can be grabbed and buffered for subsequent use in constructing two-dimensional digital images of said object as said object moves past said first, second and third light transmission apertures.

REQUIREMENT UNDER 37 C.F.R. 1.121

As required under 37 C.F.R. 1.121, and pursuant to the present Amendment, a clean version of the Specification is set forth in the attached Substitute Specification. Also, required under 37 C.F.R. 1.121 and further to the above Amendment, a clean set of pending Claims 1-42 is set forth below:

1. A planar laser illumination and imaging (PLIIM) based system comprising:

- a system housing having first, second and third light transmission apertures linearly aligned with and optically isolated from each other, and said third light transmission aperture being disposed between said first and second light transmission apertures;

- a linear image formation and detection module disposed in system housing, and having image formation optics with a field of view projectable through said third light transmission aperture and onto an object moving relative to said first, second and third light transmission apertures during object illumination and imaging operations; and

- a pair of planar laser illumination arrays (PLIAs) disposed in said system housing, each said planar laser array (PLIA) including a plurality of laser diodes arranged together in a linear manner and said planar laser illumination arrays being arranged in relation to said linear image formation and detection module, and for producing a pair of planar laser illumination beams (PLIBs), and projecting said pair of stationary planar laser illumination beams through said first and second light transmission apertures and oriented such that the plane of said planar laser illumination beams is coplanar with the field of view of said linear image formation and detection module so that the object can be simultaneously illuminated by said planar laser illumination beams and imaged within said field of view of said linear image formation and detection module,

- whereby a series of linear images of said object are sequentially detected by said linear image formation and detection module as said object moves past first, second and third light transmission apertures, so that said series of linear images can be grabbed and buffered for subsequent use in constructing two-dimensional images of said object.

2. The PLIIM-based system of claim 1, which further comprises:

- an image frame grabber for grabbing linear images formed and detected by said image linear formation and detection module,

- an image data buffer for buffering said grabbed linear images;

an image processing computer operably associated with said image data buffer, for processing said buffered linear images; and

a camera control computer for controlling said linear image formation and said detection module, and said pair of planar laser illumination arrays.

3. The PLIIM-based system of claim 1, wherein said image forming optics have a fixed focal distance and a fixed focal length providing a fixed field of view.

4. The PLIIM-based system of claim 1, wherein said image forming optics have a variable focal distance and a fixed focal length providing a fixed field of view.

5. A PLIIM-based system of claim 1, wherein said image forming optics have a variable focal distance and a fixed focal length providing a fixed field of view.

6. A PLIIM-based system of claim 1, wherein said image forming optics have a variable focal distance and a variable focal length providing a variable field of view.

7. A PLIIM-based system of claim 1, wherein said system housing has a unitary construction.

8. An over-the-conveyor belt package identification system embodying the PLIIM-based system of claim 1.

9. A hand-supportable bar code symbol reading system embodying the PLIIM-based system of claim 1.

10. A planar laser illumination and imaging (PLIIM) based system comprising:

a system housing having first, second and third light transmission apertures linearly aligned with and optically isolated from each other, and said third light transmission aperture being disposed between said first and second light transmission apertures;

a linear image formation and detection module, disposed in said system housing, and having a linear detection array and image forming optics with a field of view projectable through said third light transmission aperture and onto an object moving relative to said first, second, and third light transmission apertures during object illumination and imaging operations;

a stationary field of view folding mirror, disposed in said system housing, for folding the field of view of said linear image formation and detection module in a predetermined direction with respect to said third light transmission aperture;

a pair of planar laser illumination arrays (PLIAs) disposed in said system housing, each said planar laser illumination array including a plurality of laser diodes arranged in a linear manner and said planar laser illumination arrays being arranged in relation to said linear image formation and detection module, and producing a first and second planar laser illumination beams (PLIBs);

a pair of stationary planar laser beam folding mirrors disposed in said system housing, and arranged so as to fold the optical paths of said first and second planar laser illumination beams such that the planes of said first and second planar laser illumination beams are projected through said first and second light transmission apertures and oriented in a direction that is substantially coplanar with the field of view of said linear image formation and detection module so that the object can be simultaneously illuminated by said first and second planar laser illumination beams and imaged within the field of view of said linear image formation and detection module,

whereby a series of linear images of said object are sequentially detected by said linear image formation and detection module as said object moves past said first, second and third light transmission apertures, so that said series of linear images can be grabbed and buffered for subsequent use in constructing two-dimensional images of said object.

11. The PLIIM-based system of Claim 10, which further comprises:

an image frame grabber, disposed within said system housing, for grabbing linear images formed and detected by said linear image formation and detection module,

an image data buffer, disposed within said system housing, for buffering said grabbed linear images;

an image processing computer, operably connected to said image data buffer, for processing said buffered linear images; and

a camera control computer, disposed within said system housing, for controlling said linear image formation and said detection module.

12. The PLIIM-based system of claim 9, wherein said image forming optics have a fixed focal distance and a fixed focal length providing a fixed field of view.

13. The PLIIM-based system of claim 9, wherein said image forming optics have a variable focal distance and a fixed focal length providing a fixed field of view.
14. The PLIIM-based system of claim 9, wherein said image forming optics have a variable focal distance and a variable focal length providing a variable field of view.
15. A PLIIM-based system of claim 1, wherein said system housing has a unitary construction.
16. An over-the-conveyor belt package identification system embodying the PLIIM-based system of claim 9.
17. A hand-supportable bar code symbol reading system embodying the PLIIM-based system of claim 9.
18. A planar laser illumination and imaging (PLIIM) based system comprising:
 - a system housing having first, second and third light transmission apertures linearly aligned with and optically isolated from each other, and said third light transmission aperture being disposed between said first and second light transmission apertures;
 - a linear image formation and detection module disposed in said system housing and having a linear detection array and image forming optics with a field of view projectable through said third light transmission aperture and onto an object moving relative to said first, second and third light transmission apertures during object illumination and imaging operations;
 - a pair of planar laser illumination arrays (PLIAs) disposed in said system housing, each said planar laser illumination array including a plurality of laser diodes arranged together in a linear manner and said planar laser illumination arrays being arranged in relation to said linear image formation and detection module, and producing first and second planar laser illumination beams (PLIBs); and
 - a pair of stationary planar laser beam folding mirrors disposed in said system housing and arranged so as to fold the optical paths of said first and second planar laser illumination beams such that the planes of the first and second stationary planar laser illumination beams are projected through said first and second light transmission apertures and oriented in a direction that is coplanar with the field of view of said linear image formation and detection module so that the object can be simultaneously illuminated by said planar laser illumination beams and imaged within said field of view of said linear image formation and detection module;

whereby a series of linear images of said object are sequentially detected by said linear image formation and detection module as said object moves past said first, second and third light transmission apertures, so that said series of linear images can be grabbed and buffered for subsequent use in constructing two-dimensional images of said object.

19. The PLIIM-based system of Claim 18, which further comprises:

an image frame grabber, disposed within said system, for grabbing linear images framed and detected by said image formation and detection module,

an image data buffer, disposed within said system housing, for buffering said grabbed linear image;

an image processing computer, operably associated therewith, for processing said buffered linear images; and

a camera control computer for controlling said linear image formation and said detection module.

20. The PLIIM-based system of claim 18, wherein said image forming optics have a fixed focal distance and a fixed focal length providing a fixed field of view.

21. The PLIIM-based system of claim 18, wherein said image forming optics have a variable focal distance and a fixed focal length providing a fixed field of view.

22. The PLIIM-based system of claim 18, wherein said image forming optics have a variable focal distance and a variable focal length providing a variable field of view.

23. A PLIIM-based system of claim 18, wherein said system housing has a unitary construction.

24. An over-the-conveyor belt package identification system embodying the PLIIM-based system of claim 18.

25. A hand-supportable bar code symbol reading system embodying the PLIIM-based system of claim 18.

26. A planar laser illumination and imaging (PLIIM) based system comprising:

a system housing having first, second and third light transmission apertures linearly aligned with and optically isolated from each other, and said third light transmission aperture being disposed between said first and second light transmission apertures;

a linear image formation and detection module disposed in said system housing and having a linear detection array and image forming optics with a field of view projectable through said third light transmission aperture and onto an object moving relative to said first, second and third light transmission apertures during object illumination and imaging operations;

a field of view (FOV) folding/sweeping mirror, disposed in said system housing, for folding and sweeping the field of view of said linear image formation and detection module over a range of predetermined directions definable with respect to said third light transmission aperture;

a pair of planar laser illumination arrays (PLIAs), disposed in said system housing, each said planar laser illumination array including a linear array of laser diodes arranged together as a laser diode module, and said planar laser illumination arrays being arranged in relation to said image formation and detection module, and producing first and second planar laser illumination beams (PLIBs); and

a pair of planar laser beam folding/sweeping mirrors, disposed on said system housing, and jointly or synchronously movable with said FOV folding/sweeping mirror, and arranged so as to fold and sweep the optical paths of the first and second planar laser illumination beams through said first and second light transmission apertures, respectively, so that the folded field of view of said linear image formation and detection module is jointly or synchronously moved with said first and second planar laser illumination beams in a direction that is substantially coplanar therewith as said first and second planar laser illumination beams are swept over a 3-region of space so that the object can be simultaneously illuminated by said planar laser illumination beams and imaged within said field of view of said linear image formation and detection module,

whereby a series of linear images of said object are sequentially detected by said linear image formation and detection module as said object moves past said first, second, and third light transmission apertures, so that said series of linear images can be grabbed and buffered for subsequent use in constructing two-dimensional images of said object.

27. The PLIIM-based system of claim 26, which further comprises:

an image frame grabber, disposed within said system housing, for grabbing linear images formed and detected by said image formation and detection module,

an image data buffer, disposed within said system housing, for buffering said grabbed linear images;

an image processing computer, operably associated with said image data buffer, for processing said buffered linear images; and

a camera control computer, disposed within said system housing, for controlling said linear image formation and said detection module.

28. The PLIIM-based system of claim 27, wherein said image forming optics have a fixed focal distance and a fixed focal length providing a fixed field of view.

29. The PLIIM-based system of claim 27, wherein said image forming optics have a variable focal distance and a fixed focal length providing a fixed field of view.

30. The PLIIM-based system of claim 27, wherein said image forming optics have a variable focal distance and a fixed focal length providing a fixed field of view.

31. The PLIIM-based system of claim 27, wherein said image forming optics have a variable focal distance and a variable focal length providing a variable field of view.

32. A PLIIM-based system of claim 27, wherein said system housing has a unitary construction.

33. An over-the-conveyor belt package identification system embodying the PLIIM-based system of claim 27.

34. A hand-supportable bar code symbol reading system embodying the PLIIM-based system of claim 27.

35. A planar laser illumination and imaging (PLIIM) based system comprising:

a system housing having first, second and third light transmission apertures linearly aligned with and optically isolated from each other, and said third light transmission aperture being disposed between said first and second light transmission apertures;

a linear image formation and detection module disposed in said system housing, and having a linear detection array and image forming optics with a field of view projectable through said third light transmission aperture and onto an object moving relative to said first, second and third light transmission apertures, during object illumination and imaging operations; and

a pair of planar laser illumination arrays (PLIAs) disposed in said system housing, each said planar laser illumination array including a plurality of laser diodes arranged together, and said pair of planar laser illumination arrays being arranged in relation to said linear image formation and detection module, and for producing a first and second planar laser illumination beams (PLIBs) and projecting said first and second planar laser illumination beams through said first and second light transmission apertures and oriented, such that the plane of said planar laser illumination beams is coplanar with the field of view of said linear image formation and detection module so that the object can be simultaneously illuminated by said planar laser illumination beams and imaged within said field of view of said linear image formation and detection module;

an image frame grabber, disposed in said system housing, for accessing linear images from said linear image formation and detection module;

an image data buffer, disposed in said system housing, for buffering said grabbed linear images received from said image frame grabber; and

a camera control computer, disposed in said system housing, for controlling the operation of said PLIIM-based system;

whereby a series of linear images of the object can be grabbed and buffered for subsequent use in constructing two-dimensional digital images of said object as said object moves past said first, second and third light transmission apertures.

36. A PLIIM-based system of claim 35, which further comprises:

an image processing computer, operably connected to said image data buffer, for receiving and buffering said series of linear images so as to construct said two-dimensional digital images, and for carrying out image processing algorithms (e.g. bar code symbol decoding algorithms) and operators on said two-dimensional digital images.

37. The PLIIM-based system of claim 35, wherein said image forming optics have a fixed focal distance and a fixed focal length providing a fixed field of view.

38. The PLIIM-based system of claim 35, wherein said image forming optics have a variable focal distance and a fixed focal length providing a fixed field of view.

39. The PLIIM-based system of claim 35, wherein said image forming optics have a variable focal distance and a variable focal length providing a variable field of view.

40. A PLIIM-based system of claim 35, wherein said system housing has a unitary construction.
41. An over-the-conveyor belt package identification system embodying the PLIIM-based system of claim 35.
42. A hand-supportable bar code symbol reading system embodying the PLIIM-based system of claim 35.